2. The number of CEAs under loco-regional anesthesia increased significantly from 10.1% to 28.1% ($p < 0.0001$). Intraluminal shunting was performed less frequent (48.1% to 43.5%, $p < 0.0001$), whereas an intra-operative morphological control of the carotid artery was performed more often (44.5% to 68.3%, $p < 0.0001$). Any neuro-monitoring method was used increasingly (CEA: 49.8% to 61.4%, CAS: 33.7% to 35.8%; $p < 0.0001$). The portion of patients who were neurologically assessed before or after CEA increased from 61.7% to 69.0% and 36.5% to 57.2% respectively. In CAS 78% of the patients were assessed before and 70% after the procedure. The median time interval between the neurological index event and CEA was reduced from 25 in 2003 to 8 days in 2013 (CAS: 9 days in 2012 and 2013).

3. Combined peri-procedural stroke and death rates decreased significantly in asymptomatic patients after CEA (2.0% to 1.3%, $p = <0.001$) and remained stable for CAS (1.7%). In symptomatic patients with a 50–99% stenosis peri-operative complication rates decreased significantly (4.6% to 2.7%, $p = 0.001$) whereas CAS was associated with a risk of 3.9% in 2012 and 4.2% in 2013.

Conclusion: The analysis of the annual quality reports demonstrates that CEA and CAS were performed within acceptable stroke and death rates. While patient age is increasing the clinical outcomes after CEA have improved significantly over time. Most importantly the time interval between the neurological index event and CEA or CAS could be reduced to 8 to 9 days.

How EVAR Changed the Game: Trends in Patient Characteristics, Surgical Techniques and Outcomes of Non–-ruptured AAA Repair in Germany from 1999 to 2010

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Introduction: In this study we looked at trends in patient characteristics, surgical techniques and outcomes of non-ruptured abdominal aortic aneurysm (AAA) repair in Germany from 1999–2010, when endovascular aortic repair (EVAR) took over to be the standard of care.

Methods: Using the quality assurance registry of the German Vascular Society (DGG) between 1999 to 2010 we looked at a total of 36,594 operations (23,037 Open Repair (OR), 13,557 EVAR) for infrarenal AAA in >200 hospitals in Germany. Patient characteristics (age, ASA score, AAA diameter), surgical techniques (OR, EVAR, operation time) and outcomes (peri-operative mortality, organ complications, local complications) where analyzed using Spearman's correlation coefficient for quantitative and the Cochran-Armitage test for binary outcomes.

Results: Patient characteristics: The patient's mean age increased from 69.6 to 72.0 years ($p < 0.001$), a trend that was conducted especially by the increase of operation on octogenarians ($p < 0.001$). Also the amount of patients with an ASA score of 3 increased significantly while the amount of ASA 2 patients decreased ($p < 0.001$). There were no major changes in aneurysm morphology (mean AAA diameter 58 $\pm$ 32 mm; 31.2% concomitant iliac aneurysms; 3.5% inflammatory aneurysms). Surgical techniques: The use of EVAR increased significantly (1999: 16.7%; 2010: 62.7%; $p < 0.001$) and since 2009 EVAR is used more frequently then OR. The median operation time was 150 minutes in 1999 and 135 minutes in 2010 ($p < 0.001$).

Outcomes: The overall in hospital mortality decreased from 3.1% in 1999 to 2.3% in 2010 ($p < 0.001$). Over the observation period, cardiac (1999: 8.1%; 2010: 5.1%; $p < 0.001$) and pulmonary (1999: 7.8%; 2010: 4.8%; $p < 0.001$) complications decreased significantly. The rate of post-operative renal failure increased slightly (1999: 3.6%; 2010: 4.1%; $p = 0.017$), without increasing the rate of patients needing dialysis (1999 and 2010: 1.7%; ns.). The median length of stay was reduced from 17 days in 1999 to 10 days in 2010 ($p < 0.001$).

Conclusion: While EVAR merged to be the standard of care for infrarenal AAA within the observation period, the patients got older and less fit. Nonetheless in hospital mortality and severe systemic complications could be reduced. This study provides evidence for a significant improvement of AAA treatment.

Abdominal Compartment Syndrome in Open Repair for Ruptured AAA: Can a Selective Prophylactic Open Abdomen Strategy Improve Survival?

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Introduction: Abdominal compartment syndrome (ACS) after open repair(OR) for ruptured AAA(rAAA) carries a high risk for mortality. A selective prophylactic open abdomen (POA) strategy may help reduce the development of ACS and improve survival. The objectives of this retrospective analysis were to identify ACS incidence on a group of patients submitted to OR for rAAA, compare mortality of POA strategy with primary abdomen closure + intra-abdominal pressure(IAP) monitoring and analyse the relationship of predisposing factors for intra-abdominal hypertension(IAH)/ACS and the development of ACS.

Methods: All patients in our institution for rAAA between January 2010 and January 2015 were analysed. IAH and ACS were defined according the consensus definitions of the WSACS.

Results: 84 patients were treated with OR for rAAA during the period of the study. Patients who died in the first 24 h after admission ($n = 21$) or with missing data on intra-abdominal pressure (IAP) monitoring ($n = 17$) were excluded. Predisposing factors for IAH/ACS were considered at Hospital admission (blood pressure <70 mmHg; hemoglobin <8 g/dL; cardiopulmonary arrest) and at the end of the surgery (transfusion >6 packed red cells; lactate >40; pH < 7.30). A POA using a Bogota-VAC technique was primarily applied in 8 patients (17.4%), due to difficult primary closure of the abdomen or if a significant risk for ACS existed. Of the 38 patients with primary abdominal closure, IAH occurred in 26 patients (68.4%) and ACS developed in 13 (34.2%), with 3 patients (7.9%) requiring subsequent decompressive laparotomy.

The overall 30 day mortality was 47.6%. In the subgroup of patients who developed ACS the mortality was significantly higher than in those with normal IAP/moderate IAH (grades I/II): 61.5% vs. 12.0%, $p = 0.0026$. POA strategy was associated with reduced mortality (37.5% vs. 61.5%; $p = NS$) than in those with ACS, irrespective of secondary decompression laparotomy. None of the patients with normal IAP had 3 positive factors; 61.5% patients with ACS and 75.0% patients treated with a POA presented 3 or more predictive factors for ACS.

Conclusion: ACS is frequent in OR for rAAA and carries a high mortality risk despite secondary decompression. A strategy of POA applied to patients with high risk for ACS was associated with reduced mortality after OR for rAAA. Further research in identifying high risk patients for ACS is required to validate a standardised selective POA strategy.

5 Year Results of EVAR Used According to Instructions for Use Gives a Good General Outcome for AAA

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Introduction: When EVAR has been used with low compliance to instructions for use (IFU), considerable percentages of the patients have faced AAA sac enlargement and complications. In our institution EVAR has been used according to IFU. We wanted to explore the results after 5 years for EVAR and the disease in general with this approach.

Methods: 123 patients were intended to be treated electively with EVAR 2002–2007 using Cook Zenith stent grafts. Mean aneurysm diameter at operation was 62.7 mm (40 mm–105 mm. Indications for EVAR were as follows, aortic neck: length 15 mm or more, diameter 32 mm or less, straight configuration (cone shaped neck only with distal narrowing); iliac arteries: length >10 mm, 7.5–20 mm in diameter. In the same period 139 patients were treated by open repair.

Results: At five years, 7.3% (CI 2.7—11.9%) of the elective intended to treat patients with EVAR had an increase in aneurysm diameter. 38.2 % of patients were registered with endoleaks during the follow up period but only 5.7 % had secondary procedures.13 % of patients had secondary procedures for other reasons 12.2 % of patients had early and 6.5 % late complications during the follow up period. Aneurysm rupture was seen in 1.6 % of patients. During the 5 years of follow up there was no statistical difference in standardized mortality ratio in patients treated with elective EVAR compared to the general population.

The 1 year mortality of those electively treated with open AAA repair and EVAR was 7.6%, and 6.3 % respectively. There was no statistically significant difference seen in 1 year mortality between elective open operation and elective EVAR.

Conclusion: Adhering to proven indications for use of EVAR gives a low long-term risk for increased diameter, low mortality rate and low rate of secondary procedures in treated aortic aneurysms compared to other published results. With this approach no statistical difference in standardized mortality was seen in patients treated with EVAR compared to the general population. This is the case even if the risk for AAA rupture after treatment will still not be entirely excluded with EVAR. The strict application of EVAR does not increase the mortality from AAA even if the number of open repairs will increase.

Hypogastric Artery Management during EVAR

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Introduction: Hypogastric artery (HA) revascularization in patients affected by abdominal aortic aneurysm (AAA) and submitted to endovascular repair (EVAR) is open to debate. Aim of our study is to analyze the outcomes in patients undergoing EVAR with exclusion of one or both hypogastric arteries.

Methods: In a prospective series of EVAR patients needing HA exclusion, we retrospectively reviewed our results in terms of peri-operative (30 day) and follow up rates of intestinal and spinal cord ischemia, buttock claudication (BC), skin necrosis, and sexual dysfunction (SD) in male patients. In case of aneurysms involving a single common iliac artery or iliac bifurcation, the unilateral HA was excluded by coil embolization, vascular plug deployment or simple coverage by endograft. In case of aneurysms involving both iliac arteries revascularization of at least one hypogastric artery was attempted. Techniques of hypogastric salvage included branch devices, flow modulator stents, sandwich, and periscope and bell bottom techniques.

Results: From January 2008 to December 2014, 427 patients underwent elective EVAR; among those 104 (24.3%) had iliac involvement needing HA exclusion. In 73 patients with unilateral iliac involvement (70.1%, group UH) as many single hypogastric arteries were excluded. Thirty-one patients (29.9%) had bilateral iliac involvement (group BH): 16 of those (51.6%) had one HA excluded with revascularization of the contralateral one (group BHR); in the remaining 15 patients (48.4%) both hypogastric arteries were excluded (group BHE). No 30 day or follow up aneurysm related mortality, intestinal or spinal cord ischemia were recorded. At 30 days skin necrosis was observed in 2 patients. BC, and SD rates in group UH were 17.8% and 8.2% respectively; in group BH, BC and SD rates were significantly greater in group BHE than in group BHR (53.3% vs. 18.5% and 46.4% vs. 12.5%, respectively; $p < 0.05$). At a mean 18.6 months follow up (range 4-—47), in group BHE, BC and SD rates were persistently higher than in group UH and BHR (respectively, 40% and 46.6% vs. 8.2% and 6.8% in UH, and 6.2% and 12.5% in BHR, $p < 0.05$). Data analysis disclosed that HA coil embolization was significantly associated with 30 days BC and SD (OR 3.92; 95% CI 1.27—12.1; $p < 0.05$).

Conclusion: Our results suggest that at least one HA should be salvaged in case of bilateral involvement. Unilateral HA exclusion seems to be related to acceptable complication rates at follow up. Coil embolization seems to be related to a higher peri-operative complications rate respect to plug or coverage.

Glycated Haemoglobin Influences the Growth Rate of Abdominal Aortic Aneurysms. A Sub Study from the Population based VIVA Randomised Screening Trial

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Introduction: Several studies have reported a paradoxically negative association between abdominal aortic aneurysms (AAA) and diabetes with a reduced prevalence and progression rate by almost half. However, reason remains unsolved and could be due to elevated blood sugar level, systemic level of insulin, medication or other factors. This study aimed to evaluate the role of elevated blood sugar, as glucose can induce cross-links in the extracellular matrix.

Methods: The cohort study was based on "VIVA", the randomised clinically controlled screening trial of men aged 65 —74 in Central Denmark Region. The screening included a questionnaire, ankle brachial index measurement and measurement of the abdominal aorta by ultrasound. Furthermore, follow up for up to five years were offered to AAA cases below 5 cm in diameter, while those above were referred for surgical evaluation. At follow up, full blood samples were drawn for glycated haemoglobin (HbA1c) and analysed.

We defined diabetes as HbA1c above 47 mmol/mol or an already verified diagnosis. The analyses were performed both as a conventional case-control study, comparing patients with AAA with and without diabetes, and as a cohort study concerning growth rate.

Results: At baseline, we found 619 (3.3 %) AAAs. 114 were lost to follow up or referred for vascular evaluation. In addition, full blood samples were only possible at 9 of the 13 screening locations leaving 346 AAA patients. Sixty-nine (20%) had defined diabetes (38 with known diagnosis, 31 with high Hba1c). Compared with the patients without defined DM, the patients with diabetes differed in comorbidity seeing as they had more angina (20.9 vs. 13.0%), peripheral arterial disease (39.1 vs. 25.7%), and hypertension (71.0 vs. 50.4%). Median baseline aortic diameter was 35.4 vs. 34.0 mm with and without diabetes respectively ($p = 0.83$), while the median growth-rate was 1.66 vs. 2.66 mm/year with and without diabetes respectively ($p < 0.000$). We found a significant association between AAAs growth rate and HbA1c (Spearman's rho: -0.159, $p = 0.004$), but no association between the maximal antero-posterior AAA diameter and HbA1c (Spearman's rho: -0.088, $p = 0.112$).

Conclusion: Exploring the association between AAA and diabetes, we found an inverse relation between the growth rate of AAAs and the level of HbA1c indicating that long lasting elevated blood sugar impairs aneurysmal progression, probably by inducing cross links in the extracellular matrix.

Prosthetic Vascular Graft Infections: Cultures from NPWT Foams Are of No Value

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Introduction: In recent years prosthetic vascular graft infections are increasingly operated in a graft-preserving manner together with the use of negative pressure wound therapy (NWPT). The use of NPWT in vascular graft infection shortens the time to complete wound healing, has a high success rate, and the complication rate is low. During NWPT either polyurethane- or polyvinyl alcohol containing sponges are exchanged on a regular basis. The aim of this study was to compare bacteria retrieved from the NWPT-sponges with the bacteria detected by conventional methods in order to examine if microorganisms from NPWTW sponges help to determine the bacterial burden of vascular wounds.

Methods: Diagnostic accuracy of NPWT sponges was assessed. The standard of reference was a microbiological culture, obtained after open biopsy or graft explantation. We calculated sensitivity, specificity, positive predictive (PPV) and negative predictive values (NPV).

Results: 109 negative pressure wound therapy treatment cycles were performed among 104 patients with prosthetic vascular graft infections.